

Two new species of *Tryonia* (Caenogastropoda: Cochliopidae) from the late Pleistocene of Coahuila, northern Mexico

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ABSTRACT

Two new species of Pleistocene freshwater snails of the genus *Tryonia* Stimpson (1865) from Coahuila, northern Mexico, are described. One of them, *Tryonia hershleri* new species, belongs to a group of species that have shells with characteristic prominent axial ribs. The second species, *Tryonia pseudocircumstriata* new species, is similar to recent and fossil species from the Pecos River in the southwestern United States. Contrary to earlier practice, we propose to use different species names for Pleistocene and extant *Tryonia* from the Pecos River.

Additional Keywords: Late Quaternary, *Tryonia circumstriata*, *Tryonia stocktonensis*

INTRODUCTION

Although little investigated, the desert regions of north-eastern Mexico contain abundant lacustrine sediments with rich late Quaternary molluscan faunas (Czaja et al., 2014a; 2014b). Specimens of *Tryonia pseudocircumstriata* new species were collected from eolian sediments (inland dunes) of an ancient paleolake that occupied a huge drainage basin in the central Laguna Region, Coahuila, Mexico (Figure 1). *Tryonia hershleri* was collected in the same region but from fluvial-lacustrine deposits.

These sites contain one of the most diverse molluscan faunas of the late Quaternary of northern Mexico, with countless specimens preserved mainly in dunes sediments (Czaja et al., 2014a). The fossil material shows an excellent preservation that allows for detailed species description.

The genus *Tryonia* contains 33 recent aquatic species distributed mainly in western North America, with one species known from Guatemala and *Tryonia porrecta* from Hawaii. More than half of the species of *Tryonia* occur in the Chihuahuan Desert, where the genus shows

a high level of local endemism. However, many endemic species of *Tryonia* are endangered or already extinct because freshwater habitats are disappearing, mainly as a result of human activities (groundwater mining) (Hershler et al., 2011; 2014).

Fossil members of the genus have been described from the Miocene of Venezuela, Peru, Colombia, Brazilian Amazonia, and from the Pliocene of Guatemala (Wesselingh and Macsotay, 2006). Uncertain are Miocene records of *Tryonia* from the southwestern USA, but some of the Pliocene shells described as *Hydrobia* and *Calipyrgula* by Pilsbry (1935) from the Kettleman Hills, California, probably belong to *Tryonia* (R. Hershler, pers. comm.). So far, Pleistocene records of the genus had been known only from the United States (Hershler, 2001).

The aim of the present study is to describe the new species and to compare them with living and fossil members of the genus *Tryonia*. The present investigations form part of a broader study of fossil land and freshwater mollusks (ecology, systematics, and biogeography) from the region that began in 2013 (Czaja et al., 2014a; Czaja et al., 2014b).

MATERIALS AND METHODS

Shells of *Tryonia hershleri* new species were collected at Acatita Valley, Coahuila, Mexico, ca. 8 km north of Charcos de Risa (26°16'53.77" N, 103°4'25.96" W). These shells were collected in Pleistocene deposits exposed along the western side of a road to Laguna del Rey. The shells derive from a gravel-sand layer of fluvial-lacustrine deposits and were collected directly from a cut of approximately 2 m thickness. Similar alluvial sandy gravel beds known from various sites in the vicinity have been dated as late Pleistocene (~15,000 BP, ¹⁴C dates) by Butzer et al. (2008).

The shells of *Tryonia pseudocircumstriata* new species were collected from dune sediments in the south part of the Paleo-Lake Irritila, Coahuila, 300 m W of the locality Gabino Vázquez (25°26'17.45" N, 102°55'12.93" W).

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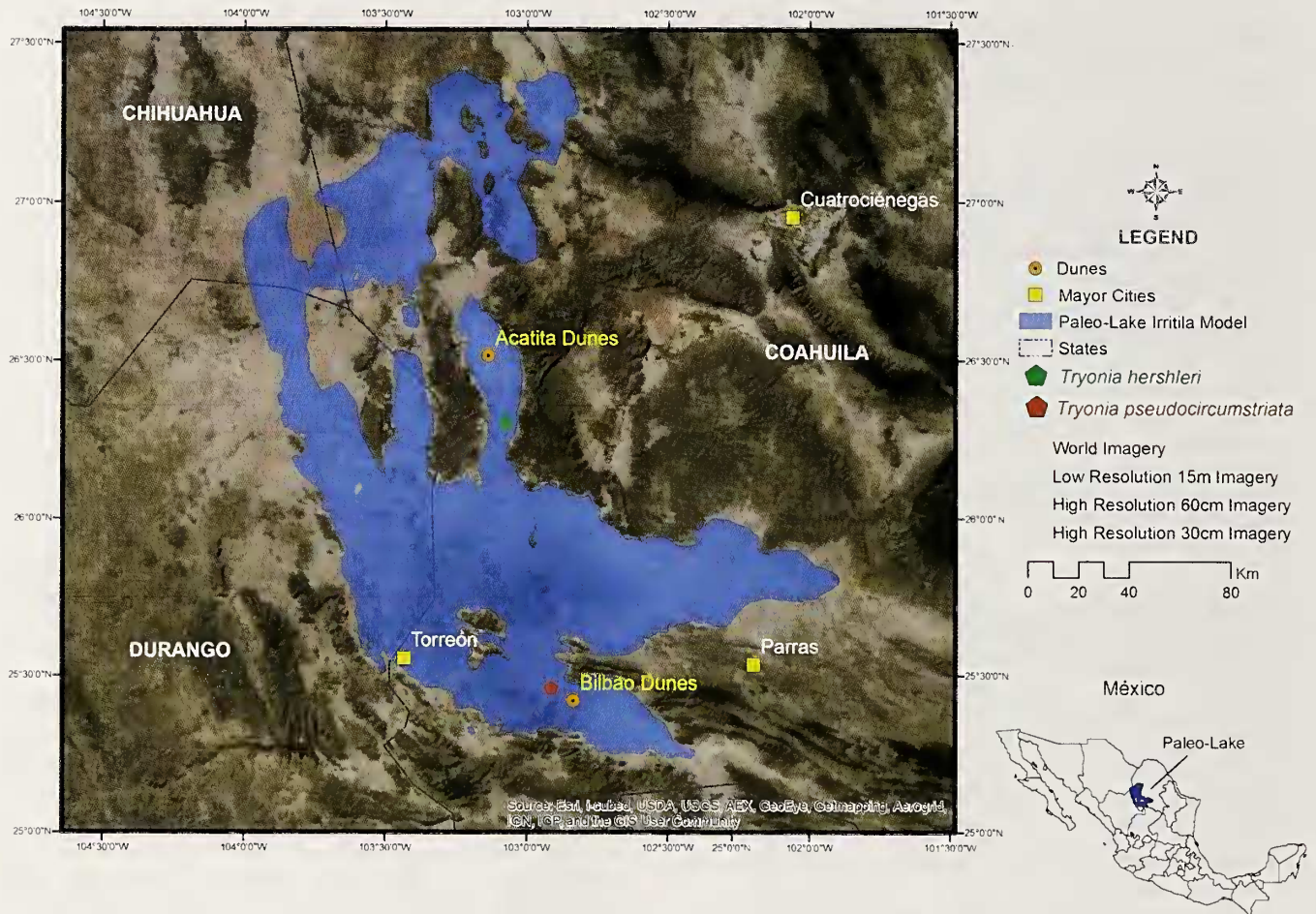


Figure 1. Map of the *Paleolake Irritila* in Coahuila, Mexico showing the collecting localities of the new species described in this paper (modified from Czaja et al., 2014a).

These eolian dunes are of Holocene age but their fossil content is older and comes from late Pleistocene lacustrine sediments (Butzer et al., 2008; Czaja et al., 2014a).

Unconsolidated sediments of both sites were screened through 0.5 mm and 0.3 mm sieves. The fossils were photographed with a Zeiss AxioCam ERc5s microscope-camera. The collected material is housed at the Faculty of Biological Science of the Juarez State University of Durango (UJED), Campus Gómez Palacio.

SYSTEMATIC PALEONTOLOGY

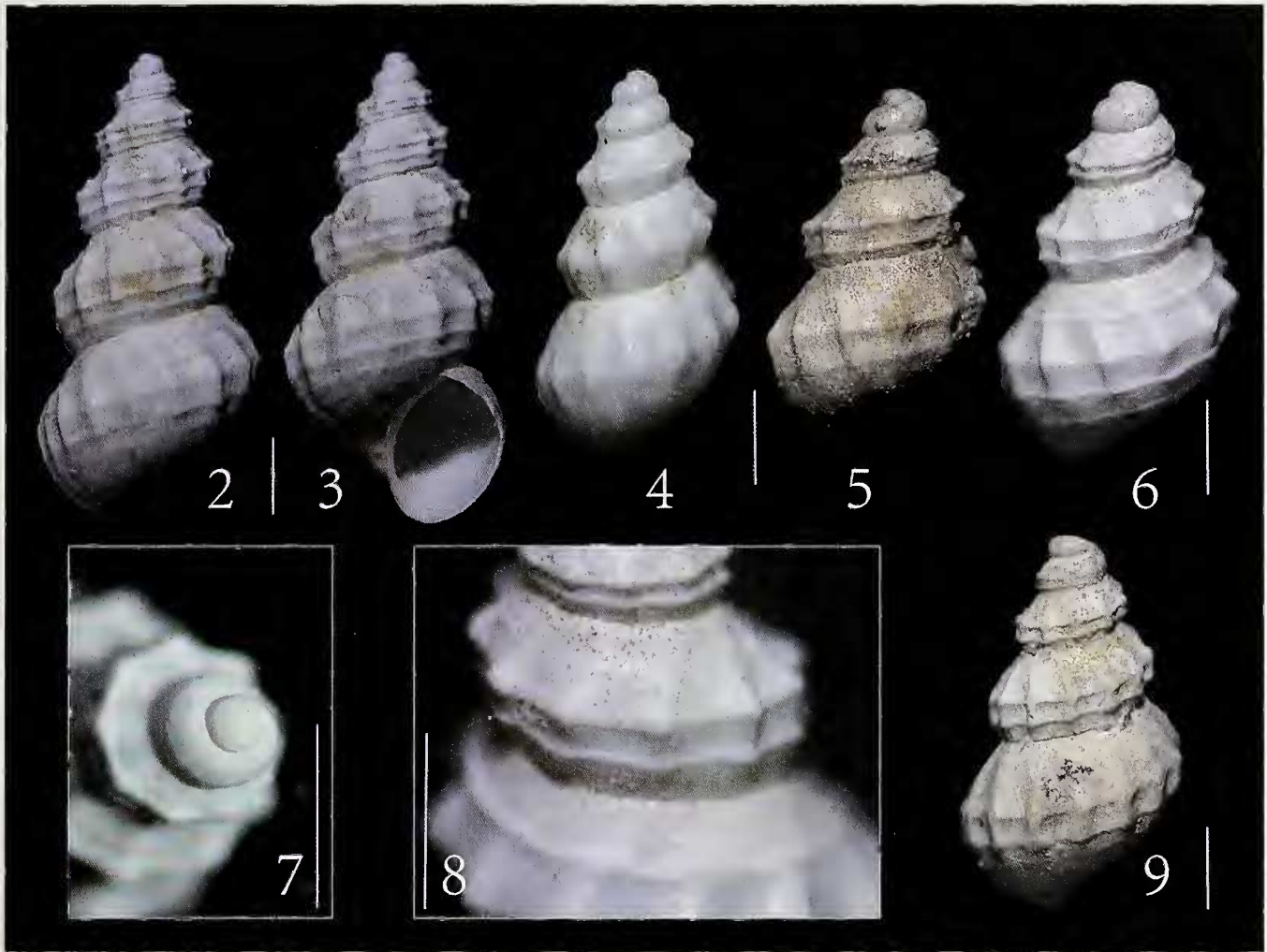
Class Gastropoda Cuvier, 1795
 Subclass Caenogastropoda Cox, 1960
 Superfamily Truncatelloidea Criscione and Ponder, 2013
 Family Cochliopidae Tryon, 1866
Genus *Tryonia* Stimpson, 1865

Type Species: *Tryonia clathrata* Stimpson, 1865 (by original designation).

***Tryonia hershleri* new species**
 (Figures 2–10, 16, Table 1)

Diagnosis: Shell medium- to large-sized, conical to turreted, with robust axial ribs, aperture ovate; distinguished from similar congeners by the pattern of shell sculpture (see taxonomic remarks).

Description: Shell medium-sized, conical to turreted, having 4.75–6.25 weakly shouldered whorls, strongly but variable sculptured. Height 3.50–5.95 mm, width 2.05–2.90 mm (shell measurements in Table 1). Protoconch smooth. Sculpture from low to robust axial ribs or almost spinose projections, ribs beginning at about second whorl, reaching their maximum size at whorl 4/5. Approximately 45 ribs present, running almost from suture to suture. About 16 ribs present on body whorl. Ribs of large shells connected with up to 5 spiral keels. Spiral lines present on middle and lower part of whorl height. Axial ribs and spiral cords forming reticulated pattern (Figure 8). Male (?) shells only with ribs, without spiral cords (Figure 4). Aperture ovate pyriform, adnate, angulate above, apertural margins not thickened on male shells. Umbiculus narrow or absent. Shells do not show great intraspecific morphological variation but sexual dimorphism is pronounced. Operculum not preserved.



Figures 2–9. *Tryonia hershleri* Czaja and Estrada-Rodríguez new species. 2–3. Holotype (UJMC-130). 4. Paratype (UJMC-131), possible male shells. 5. Brown colored specimen (UJMC-132a), 6. Small specimen (UJMC-132b). 7. Apical view of shell showing spiral sculpture on teleoconch (Holotype). 8. Shell sculpture with axial ribs and spiral keels. 9. Specimen (UJMC-133). Scale bars = 1mm.

Type Material: Holotype (Figures 2, 3, 7), UJMC-130, 5.45 mm height \times 2.63 mm width, 1.95 mm aperture length, 1.20 mm aperture width. Paratype 1 (Figure 4), UJMC-131, 4.05 mm height \times 2.05 mm width; 1.25 mm aperture length, 1.05 mm aperture width. Paratype 2, UJMC-132, 5.55 mm height \times 2.95 mm width; 2.00 mm aperture length, 1.25 mm aperture width. Alexander Czaja and José Luis Estrada-Rodríguez coll., 2013. All from type locality.

Type Locality: Late Pleistocene gravel deposits, Acatita Valley, west side of the road to Laguna del Rey, 8 km north of Chareos de Risa, Coahuila, Mexico, 26°16'53.77" N, 103°4'25.96" W.

Stratum Typicum: Late Pleistocene.

Material Examined: 320 specimens from the type locality.

Etymology: The new species is named on honor of Dr. Robert Hershler, Smithsonian Institution, for his investigations on the genus *Tryonia*.

Geographic distribution: So far only from the Paleo-Lake *Irritila*, Coahuila, Mexico.

Taxonomic Remarks: *Tryonia hershleri* new species shows morphological resemblance with species of the genus with similar shell sculpture (Figures 11–15). We include in this informal group the following fossil species:

- T. spiralistriata* Wesselingh
- T. guatemalensis* Wesselingh
- T. vivasi* Wesselingh and Macsotay
- T. nuttalli* Wesselingh
- T. scularioides tuberculata* (de Greve)
- T. scularioides scularioides* (Etheridge)

The only living members of this informal *Clathrata*-group are the type species *T. clathrata* Stimpson from Nevada, United States, and *T. exigua* (Morelet) from Lake Péten Itza, Guatemala.

The species in this group have axial ribs similar to *T. hershleri* new species, but the most similar is *T. vivasi* from the Cumaca Formation, Middle Miocene of



Figure 10. Drawing of *Tryonia hershleri* Czaja and Estrada-Rodríguez new species (Drawing of Fernando Hernandez).

Venezuela. This South American fossil species have spiral sculpture very similar to that of *T. hershleri* new species (Figure 12). The difference is that, while *T. vivasi* has up to 8 fine spiral lines, the new species from Coahuila develops 2–4 coarse spiral cords. The aperture height in relation to the height of the shell in *T. hershleri*

new species is larger than in *T. vivasi*, but the most significant difference between these two species is their size. The smallest specimens of *T. vivasi* are 6.5 mm long, the longest shells of *T. hershleri* new species measure 5.6 mm.

Shells of *Tryonia scalaroides tuberculata* Wesseligh from the Miocene Pebas Formation of Peruvian Amazonia also have spiral sculpture but only two cords on each whorl and three on the body whorl (Figure 13). Furthermore, this Amazonian species differs from *T. hershleri* new species by having a different general shape (weakly convex whorls) and one or two more whorls.

Other members of the *Clathrata*-group such as *T. spiralistriata* Wesseligh, *T. clathrata* Stimpson and *T. scalaroides scalaroides* (Etheridge) lack the characteristic keels (or have them very poorly developed) on the whorls and therefore the general pattern of the sculpture is different (Figures 11, 14, 15).

***Tryonia pseudocircumstriata* new species**
(Figures 17–27, Table 2)

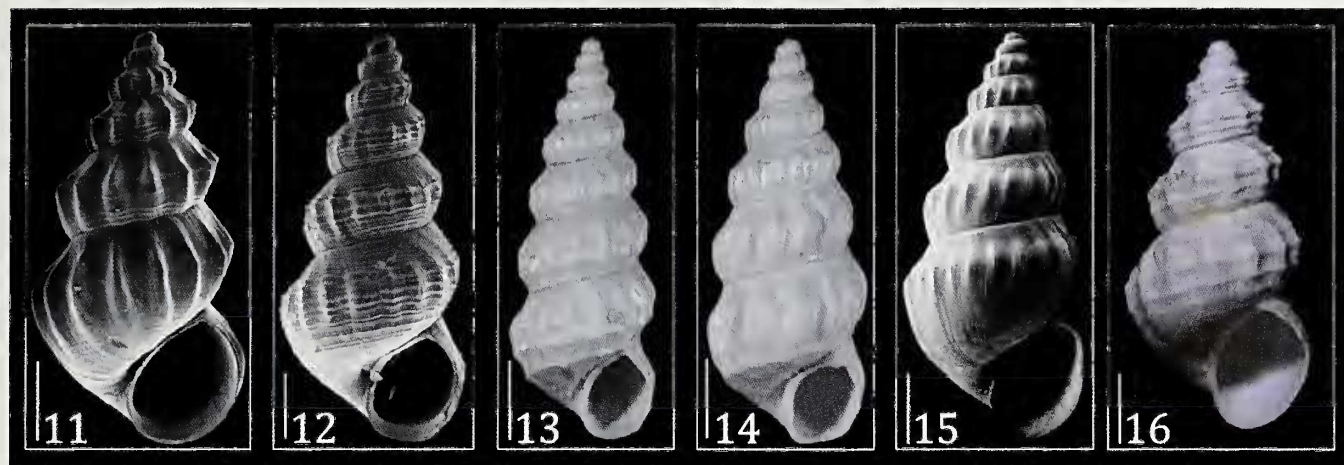
Diagnosis: Shell medium- to large-sized, conical, aperture ovate, distinguished from congeners by different ornamentation of the whorls (regularly spaced spiral lirae between sutures).

Description: Shell up to 6.5 mm high and 1.61–2.33 mm wide (shell measurements in Table 2), elongate to conic with 5.25–7.00 very weak convex whorls. Protoconch smooth (Figure 21). Teleoconch sculptured with more or less regularly spaced spiral lirae between sutures, ranging in number from 5–7 on third whorl to 12 on body whorl; last three whorls with weak collabral ribs that cross spiral sculpture. Aperture ovate-pyriform and angulate above, lip thin, adnate. Shell imperforate or narrowly umbilicate. Shells white (typical for Pleistocene material), original coloring and operculum not preserved.

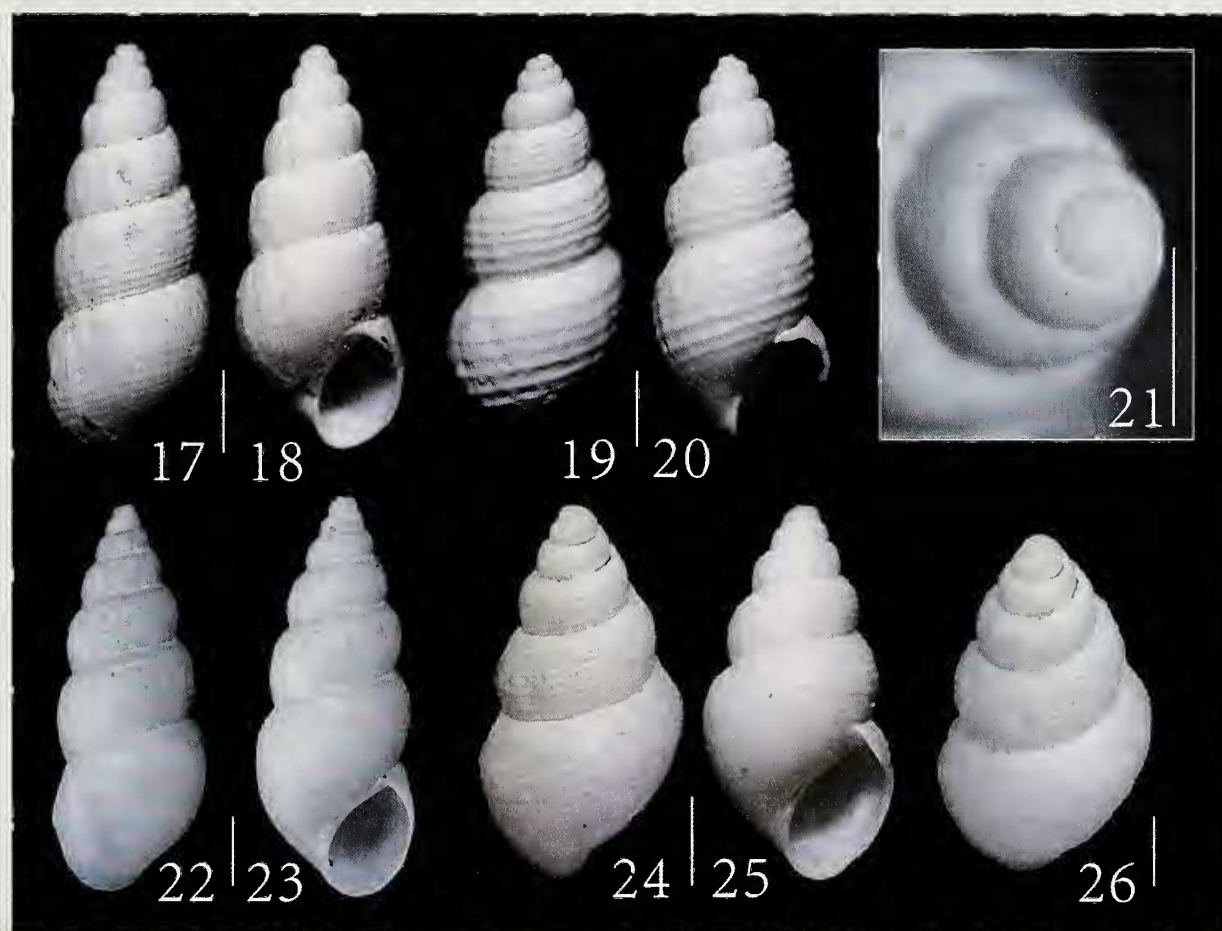
Type Material: Holotype (Figure 17, 18), UJMC-143, 5.05 mm height × 2.05 mm width; 1.25 mm aperture length, 1.05 aperture width; Paratype 1 (Figures 19, 20), UJMC-144, 5.15 mm height × 1.95 mm width; 1.30 mm aperture length, 1.05 aperture width; Paratype 2 (Figures 22, 23), UJMC-145, 4.95 mm height × 1.80 mm width; 1.25 mm aperture length, 1.05 aperture width. Alexander Czaja and José Luis Estrada-Rodríguez coll., 2013. All from type locality.

Table 1. *Tryonia hershleri* new species, shell measurements (in mm). Symbols used are: \bar{x} = mean; SD = standard deviation; N = sample size.

Specimen	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	\bar{x}	SD	N
Length	5.05	4.52	3.94	5.03	4.38	4.01	3.61	3.62	4.01	3.65	4.19	4.28	4.81	4.61	4.32	3.92	5.21	3.61	4.01	4.39	4.26	1.360	20
Width	2.20	2.25	1.99	2.23	2.31	2.12	2.03	2.02	2.10	1.97	2.12	2.29	2.60	2.51	2.33	2.03	2.39	1.87	1.99	2.20	2.18	0.190	20
No. whorls	5.50	5.25	5.25	6.25	5.25	5.00	5.00	4.75	5.25	5.00	5.25	5.00	5.25	5.00	6.00	5.25	6.25	5.00	5.00	5.25	5.29	0.416	20



Figures 11–16. Comparison of sculptured *Tryonia* species. 11. *Tryonia spiralistriata* Wesselingh and Macsotay (from Wesselingh and Macsotay, 2006, fig. 4b, reprinted with author's permission). 12. *Tryonia vivasi* Wesselingh and Macsotay (from Wesselingh and Macsotay, 2006, fig. 3a, reprinted with author's permission). 13. *Tryonia scalarioides tuberculata* (de Greve) Wesselingh (from Wesselingh, 2006, Fig. 27b, reprinted with author's permission). 14. *Tryonia scalarioides scalarioides* (Etheridge) Wesselingh (from Wesselingh, 2006, Fig. 24b, reprinted with author's permission). 15. *Tryonia clathrata* Stimpson (from Hershler, 2001, fig. 4E, reprinted with author's permission). 16. *Tryonia hershleri* new species Scale bars = 1mm.



Figures 17–26. *Tryonia pseudocircumstriata* Czaja and Estrada-Rodríguez new species. 17–18. Holotype (UJMC-143). 19–20. Paratype 1 (UJMC-144). 21. Apical view of shell showing spiral sculpture on teleoconch (Holotype). 22–23. Paratype 2 (UJMC-145), smooth specimen. 24–26. Width specimen (UJMC 146). Scale bars = 1mm.

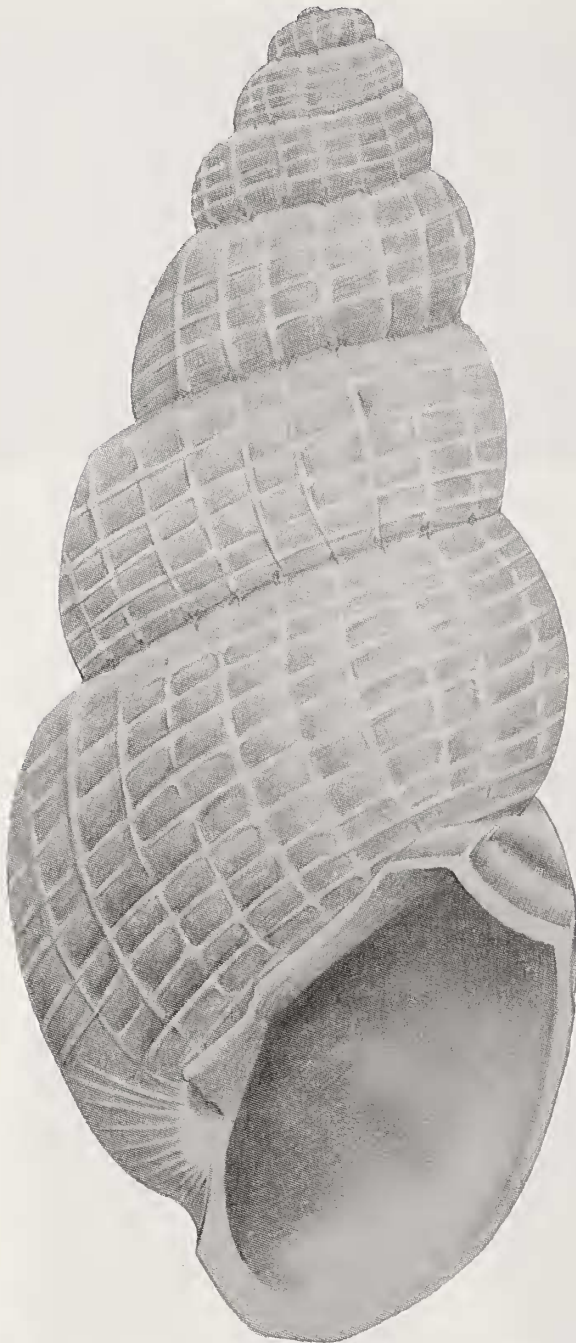


Figure 27. Drawing of *Tryonia pseudocircumstriata* Czaja and Estrada-Rodríguez new species (Drawing of Fernando Hernandez).

Type Locality: Dunas Bilbao near Viesca, Coahuila, late Pleistocene, 25°26'17.45" N, 102°55'12.93" W.

Stratum typicum: Late Pleistocene.

Material examined: 85 specimens from type locality.

Etymology: The species name alludes to its morphological resemblance to *Tryonia circumstriata* (Leonard and Ho, 1960) from the Pleistocene of Pecos County, Texas, United States.

Geographic Distribution: Thus far known only from Bilbao Dunes, southern part of the Paleo-Lake *Irritila*, Coahuila, Mexico.

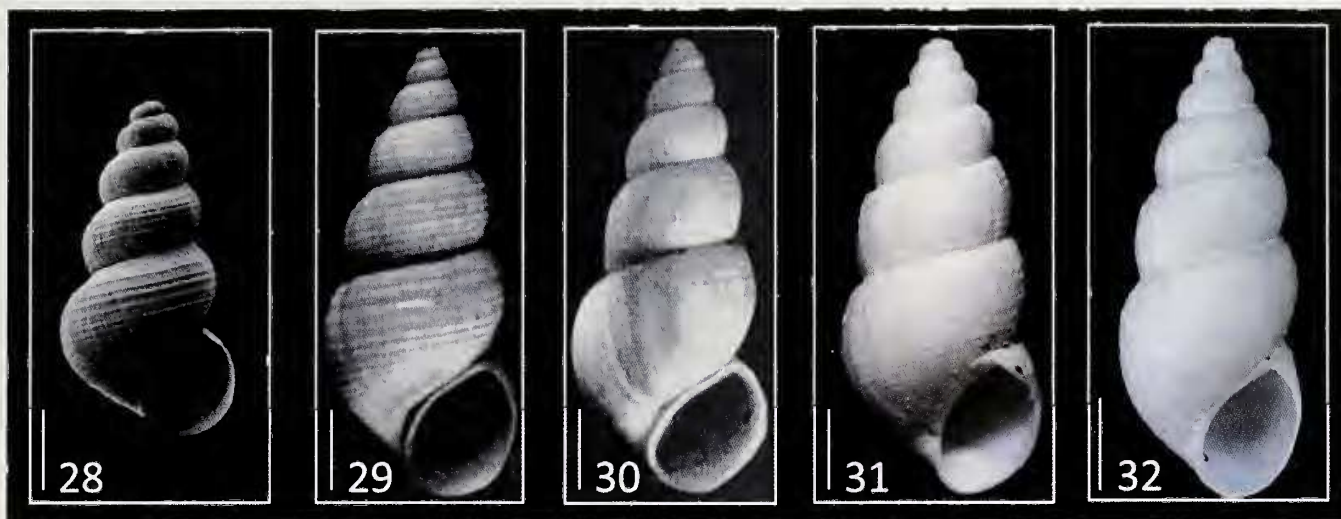
Taxonomic Remarks: The most characteristic feature of this new species is its teleoconch with regularly spaced spiral lirae (Figure 27). *Tryonia pseudocircumstriata* new species closely resembles (as its name indicates) *T. circumstriata* from the Pecos River deposits, Texas, United States. This species was first described by Leonard and Ho (1960) based on Pleistocene material. Subsequently, in the vicinity of the Pleistocene site, a living species was found by Taylor (1987) and named *Tryonia stocktonensis* (Gonzales Spring Snail). However, Hershler and Thompson (1992) did not find difference between the fossil and Recent material and place *T. stocktonensis* in synonymy with *T. circumstriata*. However, in our opinion, the Pleistocene and recent shells from Texas are different and should not be considered as a single species. The general shape of the fossil and the recent shells is clearly different, as made evident by the different convexity of the whorls (Figures 28–30). Sutures are also different, very deeply incised in the Pleistocene shells and shallow in the recent material (Figures 28, 29). Finally, there are differences in the size of the shells that go beyond intraspecific variability. According to Taylor (1987), the recent and endemic *T. stocktonensis* have a length range of 2.34–3.67 mm, whereas the fossil shells are within the 3.7–4.9 mm range, clearly larger.

We think that these mentioned morphological differences between the Pleistocene and recent shells from Texas make it impossible to place both in the same species. We propose to use the name *Tryonia circumstriata* only for the Pleistocene material from the Pecos River and *Tryonia stocktonensis* Taylor for the Recent endemic shells of the same region.

Our Pleistocene material from Coahuila shows generally more similarities with the Pleistocene shells from

Table 2. *Tryonia pseudocircumstriata* new species, shell measurements (in mm). Symbols used are: \bar{x} = mean; SD = standard deviation; N = sample size.

Specimen	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	\bar{x}	SD	N
Length	4.00	5.00	4.00	3.31	4.09	4.72	4.00	3.71	4.00	4.00	4.00	5.01	4.92	4.32	4.12	4.00	3.99	4.00	5.00	4.33	4.23	0.468	20
Width	1.91	1.81	1.89	1.40	1.88	1.95	1.92	1.81	1.59	1.99	1.97	2.09	2.00	1.92	1.61	1.86	1.59	1.75	2.00	1.98	1.85	0.176	20
No. whorls	5.25	6.00	6.00	5.00	6.00	7.00	6.00	6.00	6.00	7.00	6.75	7.00	6.25	6.00	6.00	6.25	6.00	6.25	7.00	6.00	6.19	0.543	20



Figures 28–32. Comparison of *Tryonia pseudocircumstriata* new species with similar Pleistocene and present-day species. **28.** *Tryonia stocktonensis* Taylor, present-day endemic species from Diamond Y Draw, Pecos County, Texas (from Hershler 2001, Fig. 4H, USNM 883958, reprinted with author's permission). **29.** *Tryonia circumstriata* (Leonard and Ho) from Late Pleistocene of Pecos River deposits, Terrell County, Texas (holotype *Calipyrgula circumstriata* Leonard and Ho, 1960, Plate 12, Fig. 1, No. 11301). **30.** *Tryonia circumstriata* (Leonard and Ho) from Late Pleistocene of Pecos River deposits, Terrell County, Texas (paratype 1 *Calipyrgula circumstriata* Leonard and Ho, 1960, Plate 12, Fig. 2, No. 11302). **31.** *Tryonia pseudocircumstriata* new species, holotype (UJMC-143). **32.** *Tryonia pseudocircumstriata* new species, paratype (UJMC-145). Scale bars = 1mm.

Texas (Figures 29–32). The shells from Coahuila differ from fossil *T. circumstriata* in having only slightly convex whorls while the species from Texas have more rounded whorls. The apertures are also different: in all specimens of *T. pseudocircumstriata* new species the inner lip is always adnate to the parietal wall while specimens of *T. circumstriata* show a narrow gap between the lip and parietal wall (Figures 29–32).

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